Originally a mathematician, Hester Bijl became the first female full professor at the faculty of Aerospace Engineering of the TU Delft. She currently leads the Aerodynamics section and chairs the Aerodynamics and Wind Energy department. In her room at the High Speed Wind Tunnel Laboratory we talk with her about her career, which among many other things includes working as a consultant at The Boston Consulting Group and being a member of the jury on the television quiz Hoe? Zo!. As we sit behind her desk, overlooking a battlefield of books, papers and reports, we come to know one of the scarce female professors at the TU Delft...
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So why did you go to the university and specifically to the Chair of Aerodynamics? I missed science and teaching. I had seen a lot of the world and really enjoyed my time in the business community. When I was working for my doctoral degree I had to work on one and the same problem for quite a long time and on my own. Since I had enough of that I decided I wanted to do something in a group of people and more different assignments in a short time. This is what I could do at the Boston Consulting Group, but for me it was a surplus of projects over there and I longed to have more continuity and be able to really think something through. Above that I always liked to be a teacher: I already played to be one at the age of ten! Back then I put my dolls in front of me and gave them lectures. When I became a PhD I also gave Calculus lessons to first year students, so I already had some experience. And last but not least, aerodynamics has always attracted me as a nice application of mathematics; hence when there was a vacancy here I decided to take it. Over here I am involved in many projects, have contact with many students, PhD’s and professors, give lectures to students and have the time to develop myself.

Now you are professor at the Chair of Aerodynamics. What are currently your activities?

My own research focuses on simulating complex flows more accurately and efficiently. For example unsteady flows and flows interacting with structures. On one hand we try to accurately solve the problems faster and smarter. Most calculation methods which are being used at this moment were originally developed for steady problems. You can of course apply them to different moments in time to get an unsteady solution, but this is not very efficient. We also try to think about the time integration method. The standard computer algorithms have been developed ten to fifteen years ago. Mathematicians work with five or ten unknowns, we work with ten million unknowns in many different scales of time and space. Hence, when we see a calculation method with potential, we still have to redesign it before it’s applicable.

I also work on uncertainty quantification methods. In a European project with companies like Dassault and Airbus we try to include the effect of uncertainties in our simulations. Instead of ‘exactly solving the wrong problem’ we try to solve a probabilistic problem maybe less precise, but for a whole input distribution. For example, instead of simulating the flow for one angle of attack, Mach number or geometry we work with fluctuations. (These fluctuations can come from the atmosphere or from production tolerances.) The question is how these fluctuations influence the output, say lift and drag. We can compute that now in a limited amount of time. Next step is to use this in the design process. Ideally you want a robust optimum, a domain C/C. However, in that optimum is very sensitive to a small variation you may want to go for a less optimal but more stable point.

Of course here at Aerodynamics there is a whole team of researchers who develop measurement techniques, perform experiments in wind tunnels and who apply the methods to flow control and aerodynamic design questions. Up until now the experimenters did measurements, and we did computations and then we compared the results. Now we are working on methods to truly integrate both worlds in order to find a good method for analysis of the flow based on both experiments and simulations. This is, however, a very new field of research.

What are your ambitions and that of the Chair?

At this moment for the simulations, we are still working on different building blocks...
like taking uncertainties into account, implementing experimental results and speeding up the numerical calculations. My ambition is that, in approximately ten years, we can combine all these building blocks into one robust solver which can optimize the shape and control properties by itself. I hope we can accomplish this in the near feature. For the Chair the ambition has and always will be to better understand complex flows and be able to influence them with flow control techniques and come up with new aerodynamic designs.

How do you experience being a successful woman at a technical university, which has the reputation of being more of a man’s world? Since I already have been studying at the TU Delft since my seventeenth I am not unaccustomed to the male environment over here and have never bumped my head to any glass ceiling or something like that. However, although I have never considered the absence of women a burden, I would appreciate it if more women started to work or study at the TU Delft. A little bit of variety is simply good for the environment and the people working in that environment. And we miss a lot of talent in this way.

Could you explain the lack of girls starting at the technical university? Well, in mathematics it wasn’t that bad. In my year about thirty percent of the people studying mathematics were girls. And after some intensive recruiting activities there was even a moment when fifty percent of the mathematics students were girls. But Aerospace Engineering is a different story and a lot of work still has to be done in order to have more girls to start their studies here. But I haven’t got a clue why girls are not very interested in doing a technical study like Aerospace Engineering. There used to be an organization called Technika 10 and they think it already goes wrong during primary education. Girls simply have a different learning approach than boys: when they are challenged by a technical problem they like to first think things through before they start to do something. Boys, however, immediately get to work when they are faced by the same problem. This slows the girls down and they get the idea they are not as capable as the boys in solving a technical problem, while actually they just have a different solution strategy. Technika 10 used to organize educational afternoons for girls from around 10 years old in which they can do technical stuff without boys interfering and taking away the girls’ opportunities to develop their technical skills. Unfortunately the national organization recently had to stop. I am happy that the local initiatives still continue.

On the sideline you have been a member of the jury on the television quiz Hoe?Zoi! Do you think it is important to have a TV program which promotes science? Science needs promotion. I think it is useful to show people the value of science and how much fun it can be. Science does not have a very good lobby in politics or on Dutch television. I always consider art to have a much better lobby. In this age of marketing and appearance this is bad. The image most people have of science is important. When people mistakenly picture science as old men with beards doing something completely useless for society, then they are more easily inclined to for example tighten up on funding science. So in that respect it is crucial to show people what we are doing and how that can be useful to society; most important, of course, scientific education of students, but also the science in itself.

After the interview we mention the battle-field of books, papers and reports on professor Bijl’s desk and we ask her whether this is an organized chaos. After a loud laughter she comments: “My supervisor always told me that an empty desk indicates a clear head, but I have always been trying to oppose that statement. I also have a clear head, I think” A comforting thought for a lot of students, probably.

Figure 3. XRS-2200 linear aerospike engine being tested; aerospike engines maintain their aerodynamic efficiency across a wide range of altitudes

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